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To understand the possible environmental interactions of uranium with the radioresistant bacterium *Deinococcus radiodurans* we have characterized its sorption complex chemically and spectroscopically. The binding strength, pH sorption edge, selective blocking of cell-surface functional groups, and competition with known complexors support laser fluorescence and infrared spectroscopic data indicating that a carboxyl surface group, consistent with known characteristics of *D. radiodurans*' S-layer, interacts with and binds the uranium.

Although its high survivability in gamma radiation fields has been well studied, the effects of alpha particles from uranium bound to its surface may affect its survivability and interaction with the environment. Using Helium and Nitrogen nuclei cyclotron beams to mimic the effect of typical actinide alpha particles, we explored the ability of *D. radiodurans* to survive ion irradiation. In addition, a Co-60 gamma source was used to study the effects of environmental conditions on survivability.